Allergy 2009: 64: 1061–1067

DOI: 10.1111/j.1398-9995.2009.01956.x

Original article

Under-report and underdiagnosis of chronic respiratory diseases in an African country

Background: Chronic respiratory diseases (CRD) are greatly underestimated. The aim of this study was to assess the burden associated with reported CRD and chronic obstructive pulmonary disease, as defined on the basis of various standardized criteria, by estimating their point prevalence in a sample of individuals attending the Primary Health Care (PHC) level and Emergency Room (ER) Departments in Cape Verde (CV) archipelago. The second aim of the study was to identify factors related to airways obstruction and reported CRD in this population.

Methods: A cross-sectional study was carried out in CV during 2 weeks. Outpatients aged more than 20 years seeking care at PHC level and ER answered a standardized questionnaire and were subjected to spirometry, independently of their complaint. Two criteria for airways obstruction were taken into account: forced expiratory volume (FEV_1) $<80\%$ of the predicted value and FEV_1/forced vital capacity (FVC) ratio <0.70.

Results: A total of 274 individuals with a satisfactory spirometry were included. 22% of the individuals had a $FEV_1 < 80\%$. Individuals older than 46 years had a higher risk of having airways obstruction. Asthma diagnosis (11%) had a clear association with airways obstruction. Smoking was a risk factor for a lower FEV_1. Working in a dust place and cooking using an open fire were both related to chronic bronchitis and asthma diagnosis.

Conclusion: Under-report and underdiagnosis of chronic respiratory conditions seem to be a reality in CV just as in other parts of the world. To improve diagnosis, our results reinforce the need of performing a spirometry.

P. Martins[1,2], J. Rosado-Pinto[1], M. do Céu Teixeira[3], N. Neuparth[2], O. Silva[4], H. Tavares[5], J. L. Spencer[4], D. Mascarenhas[6], A. L. Papoila[7], N. Khaltaev[8], I. Annesi-Maesano[9,10]

[1]Immunoallergy Department, Dona Estefânia Hospital, Lisbon, Portugal; [2]Pathophysiology Department, CEDOC/FEDER, Faculty of Medical Sciences, New University of Lisbon, Lisbon, Portugal; [3]Pediatrics Department, Agostinho Neto Hospital, Praia, Cabo Verde; [4]Pneumology Department, Dr. Baptista de Sousa Hospital, Mindelo, Cabo Verde; [5]Medicine Department, Agostinho Neto Hospital, Praia, Cabo Verde; [6]Medicine Department, Dr. Baptista de Sousa Hospital, Mindelo, Cabo Verde; [7]Biostatistic and Informatics Department, CEAUL, Faculty of Medical Sciences, New University of Lisbon, Lisbon, Portugal; [8]Global Alliance Against Chronic Respiratory Diseases (GARD) Adviser, C/O Chronic Respiratory Diseases and Arthritis, Noncommunicable Diseases and Health Promotion, WHO, Geneva, Switzerland. Allergic Rhinitis and its impact on Asthma (ARIA), University Hospital, Montpellier, France; [9]INSERM, UMR S 707: EPAR, Paris, France; [10]UMR S 707: EPAR, Université Pierre et Marie Curie, Paris, France

Key words: chronic respiratory diseases; spirometry; under-report.

Pedro Carreiro Martins
Immunoallergy Department
Dona Estefânea Hospital
Rua Jacinta Marto
Lisboa 1169-045
Portugal

Accepted for publication 5 December 2008

Chronic respiratory diseases (CRD), including chronic obstructive pulmonary disease (COPD), constitute a serious public health problem in all countries, particularly in developing countries (1). Chronic respiratory diseases are often under-reported and underdiagnosed (2, 3). This is the case of COPD, which is usually undiagnosed until it becomes clinically apparent and moderately advanced (4). According to the type of definition used, COPD prevalence has been estimated to range from 4% to 20% in adults over 40 years of age (5, 6) with a considerable increase with age, particularly among smokers. COPD, nevertheless, may also occur in people aged 20–44 years (7). In a meta-analysis, the pooled prevalence of COPD was 7.6% (6.4% for chronic bronchitis and 1.8% for emphysema). The prevalence from spirometric estimates was 8.9% (8).

Chronic obstructive pulmonary disease may be less common in developing countries because of younger populations and lower tobacco consumption compared with industrialized countries (9). Tobacco smoking is the

single most important factor in the genesis of COPD and is responsible for more than 75% of cases worldwide (10). However, there is a link between COPD and biomass fuel combustion, which is largely used in developing countries.

Data on CRD and related risk factors are scarce in most developing countries, particularly in sub-Saharan Africa. Diagnosis of CRD in developing countries is not a simple process. Tests like spirometry are not readily available, thus resulting in incorrect assessment, underdiagnosis and consequent undertreatment (1).

Cape Verde (CV) Republic is an African country located in the Gulf of Guinea. Cape Verde is a middle income country that ranks the position 102 in the Human Development Index 2007 (11). It is comprised of 10 islands with a total area of 4033 km^2 for a total of 0.5 million people. Santiago is the largest island and it has about 236000 inhabitants. São Vincente it is the seventh largest and the second most populated island with 67000 inhabitants (census of 2000). The prevalence of asthma in children is around 10% (12) and there are no published data for other CRD.

We carried out a cross-sectional study in October 2006 in these two islands in order to assess the occurrence of COPD, as defined on the basis of various spirometric standardized criteria and reported CRD by estimating their point prevalence during 2 weeks, and to identify risk factors associated with them. We studied a sample of individuals seeking for health care at the Primary Health Care (PHC) level and the Emergency Room (ER) Departments during 2 weeks.

Methods

Procedures

The survey was conducted according to a protocol implemented by Isabella Annesi-Maesano, Paolo Matricardi and Nikolai Khaltaev in the frame of the Global Alliance Against Chronic Respiratory Diseases (GARD) (a short version is included as Annex 1). It consisted of the administration of a standardized questionnaire (GARD pilot study, Portuguese translation for CV) followed by a lung function assessment in a sample of individuals. This study constitutes the first application of this protocol and deals more particularly with the spirometric data.

The target population was constituted by outpatients older than 20 years seeking care at PHC level and ER in Santiago and São Vicente islands during 2 weeks, independently of their complaint. All the PHC of Santiago and São Vicente islands were prepared previously by the CV GARD team. From 14 PHC, 12 (10 in Santiago and two in São Vicente) and two ER departments (one in each island) participated in the study. Two PHC did not participate because of difficulty in accessing.

Questionnaire

The questionnaire was derived from the Burden of Obstructive Lung Disease (BOLD) study questionnaire (13). It was translated from English to Portuguese, and then back-translated to ascertain accuracy. The staff those who distributed the questionnaire were trained and certified. It included questions about respiratory symptoms and diseases, risk factors (smoking history, type of cooking…), practice of respiratory-related health care and limitation of activities. It was administered in the waiting room by an interviewer (doctor or nurse) prior to the medical visit and collected by the general practitioner at the end of the consultation. The interviewer read clearly all the questions and repeated it in the case the patient did not understand it. If the patient did not know a 'term', a negative answer was assumed.

According to the standardized definition, chronic bronchitis was defined as the presence of cough and sputum production for at least 3 months in each of two consecutive years. Asthma, emphysema, tuberculosis were defined on the basis of the presence of a medical diagnosis ('Has a doctor ever told you that you had…'). Smoking was defined as more than 20 packs of cigarettes or 12 oz of tobacco in a lifetime or at least one cigarette a day for 1 year. A current smoker was considered for those who smoked during the last 30 days. Occupational exposure was assumed for those who have ever worked for a year or more in any dusty job. Patient's job at the time of the questionnaire was also enquired. Open fire exposure was considered for affirmative answers to the question 'Do you cook using an open fire'. Lastly, living in an urban region (city) was separated by living in a rural region.

Spirometry

After the questionnaire, a spirometry was performed on the same day using a portable pneumotachograph (Vitalograph Compact, Vitalograph, Buckingham, UK) according to standardized guidelines (14). All the examinations were performed by a trained operator and under the supervision of a Pneumologist or Allergologist. ECCC/ERS (European Community for Steel and Coal/European Respiratory Society) reference equations (15) were used in the population studied to assess the predicted values as we have used it in previous visits to CV under the collaboration program of the Health Ministries of Portugal and CV, within the frame of Chronic Respiratory Diseases. Ethnic group adjustment was perfomed for non-Caucasian individuals. Calibration was checked daily with a 3-L syringe. Participants did up to eight forced expiratory manoeuvres to obtain three acceptable manoeuvres, with forced vital capacity (FVC) and forced expiratory volume (FEV_1) reproducible within 150 ml. All spirometric examinations were performed with the person seated, wearing a nose clip and a disposable mouthpiece.

Two criteria for airways obstruction were taken in account: an $FEV_1 < 80\%$ (16) of the predicted value and FEV_1/FVC ratio < 0.70 (17). Furthermore, the severity of airways obstruction was defined according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) initiative (17) as follows: Stage 0 – chronic symptoms and normal spirometry; Stage I – $FEV_1/FVC < 0.70$ and $FEV_1 \geq 80\%$ predicted; Stage II – $FEV_1/FVC < 0.70$ and $50\% \leq FEV_1 < 80\%$ predicted; Stage III – $FEV_1/FVC < 0.70$ and $30\% \leq FEV_1 < 50\%$ predicted; Stage IV – $FEV_1/FVC < 0.70$ and $FEV_1 < 30\%$ predicted.

Statistical analysis

An exploratory analysis of the variables of interest was carried out [sex, age, Body Mass Index (BMI), smoking status, occupation, living in an urban *vs* rural area, occupational exposure and domestic fuel exposure]. The occurrence of asthma, chronic bronchitis, emphysema and tuberculosis (point prevalence) and the mean value of the spirometric variables were estimated in the sample.

Table 1. Description of the sample

	Total	Men	Women	*P*-value
Sex	274 (100%)	96 (35%)	178 (65%)	
Age				
Median [Q1–Q3] in years	38 [28–50]	43 [30–57]	36.5 [27–48]	0.017
20–45 years	179	53	126	
≥46 years	95	43	52	
BMI				
Median [Q1–Q3]	24.1 [21.4–26.6]	24.0 [21.2–26]	23.8 [21.5–27]	ns
Occupation				
Have a job	163 (59.5%)	60 (63.2%)	103 (58.2%)	ns
Smoking status				
Never	240 (87.6%)	69 (71.9%)	171 (96.1%)	<0.0001
Ex-smoker	18 (6.6%)	14 (14.6%)	4 (2.2%)	
Current smoker	16 (5.8%)	13 (13.5%)	3 (1.7%)	
Exposure to dust at workplace				
Past exposition	110 (40.1%)	54 (56.2%)	56 (31.5%)	<0.0001
Cooking/heating				
Using an open fire	124 (45.3%)	26 (27.0%)	98 (55.0%)	<0.0001

BMI, Body Mass Index; Q1, first quartile; Q3, third quartile; ns, not significant.

Frequencies, percentages and means were calculated using classical statistics (18). The chi-squared test was used to compare proportions. The *t*-test analysis and the Mann–Whitney were used to compare mean values in different groups. A univariate study was performed to calculate the crude odds ratios of the associations between two variables. Adjusted odds ratios and corresponding confidence intervals were obtained as a result of fitting a multivariate logistic regression model to the data. Cohen's Kappa coefficient was used to measure the agreement between the clinical status reported by the participants and the spirometric classification. According to the literature, agreement was classified as follows: < 0: no agreement, 0–0.2: slight, 0.21–0.40: fair, 0.41–0.60: moderate, 0.61–0.80: good and 0.80–1.00: excellent (19). The level of significance considered was $\alpha = 0.05$, although P values greater than 0.05 and lower than 0.1 were still reported to indicate trends. SPSS (Statistical Package for the Social Sciences, 15.0; Chicago, IL, USA) for Windows was used to analyse the data.

Results

A total of 314 individuals older than 20 years answered the questionnaire and 274 (87.2%) were subjected to spirometry. Seventy-five per cent were performed in Santiago island, which respect the proportion of the population among the islands. Women outnumbered men in both islands in a high proportion than the real demographic distribution (51.6% of women in the whole population of CV). The description of the sample is presented in Table 1. Forty individuals who did not achieve a valid spirometry were younger (41.5 ± 16.2 years *vs* 32.7 ± 14.8 years, $P = 0.001$). No difference was found for gender, having a job, risk factors and diseases. Table 2 presents spirometric mean values in the sample. As expected, the FEV_1 and FEV_1/FVC ratio declined with age.

Table 3. Prevalence of major respiratory diseases and spirometric alterations

	Total	Men	Women	*P*-value
Asthma	30 (10.9%)	9 (9.5%)	21 (11.8%)	ns
Chronic bronchitis	28 (10.2%)	14 (14.7%)	14 (7.9%)	0.075
Emphysema	6 (2.2%)	3 (3.2%)	3 (1.7%)	ns
Tuberculosis	9 (3.3%)	6 (6.3%)	3 (1.7%)	0.040
Spirometric alterations				
$FEV_{1\%}$ < 80% predicted	60 (21.9%	26 (27.4%)	34 (19.1%)	ns
FEV_1/FVC < 0.70	23 (8.4%)	10 (10.5%)	13 (7.3%)	ns
COPD GOLD				
Stage 0	21 (7.7%)	10 (10.4%)	11 (6.1%)	ns
Stage I	4 (1.5%)	2 (2%)	2 (1.1%)	ns
Stage II	8 (2.9%)	4 (4.1%)	4 (2.2%)	ns
Stage III	10 (3.6%)	4 (4.1%)	6 (3.3%)	ns
Stage IV	1 (0.03%)	0 (0%)	1 (0.06%)	ns

FVC, forced vital capacity; FEV_1, forced expiratory volume in first second; COPD, chronic obstructive pulmonary disease; GOLD, Global Initiative for Chronic Obstructive Lung Disease; ns, not significant.

In the 2 weeks of study, 10.9% were reported to suffer from asthma (Table 3). 10.2% of individuals suffered from chronic bronchitis, with men reaching 14.7% compared with 7.9% of women. Men also suffered more with emphysema than women, but the difference was not statistically significant (3.2% *vs* 1.7%). Tuberculosis history was also more frequent in men (6.3% *vs* 1.7% in women, $P = 0.040$).

In the 274 individuals with a satisfactory spirometry, 22% had an $FEV_1 < 80\%$ and 8% $FEV_1/FVC < 0.70$ (Table 3). $FEV_1 < 80\%$ of the predicted value and $FEV_1/FVC < 0.70$ were more frequent in men than in women, without reaching significance. Based on the

Table 2. Mean values of age, percent predicted FEV_1 and FEV_1/FVC ratio (mean ± SD)

	Men			Women		
	20–45 year	≥46 year	Total	20–45 year	≥46 year	Total
n	53	43	96	126	52	178
Age (years)	31.7 ± 7.5	61.1 ± 12.2	44.8 ± 17.7	35.0 ± 5.7	59.3 ± 10.9	39.3 ± 15.1
$FEV_{1\%}$	92.9 ± 16.9*	85.5 ± 22.8	89.7 ± 19.2	95.7 ± 14.34†	86.8 ± 24.3	92.7 ± 18.2
FEV_1/FVC	0.82 ± 0.08‡	0.76 ± 0.09	0.80 ± 0.09	0.83 ± 0.07‡	0.75 ± 0.13	0.81 ± 0.1

FVC, forced vital capacity; FEV_1, forced expiratory volume in first second.
Analysis between age groups: *$P = 0.063$, †$P = 0.095$, ‡$P < 0.0001$; no differences for sex.

Table 4. Agreement table between respiratory diseases and spirometric changes

	FEV_1 < 80%		FEV_1/FVC < 0.70	
	No	Yes	No	Yes
CB				
No	193	53	226	20
Yes	21	7	25	3
OR	1.13 (0.44–2.90), $P = 0.800$		1.31 (0.34–5.05), $P = 0.696$	
Emphysema				
No	212	56	246	22
Yes	2	4	5	1
OR	4.99 (0.85–29.44), $P = 0.076$		1.07 (0.11–10.01), $P = 0.950$	
Asthma				
No	199	41	232	8
Yes	13	17	16	14
OR	5.93 (2.69–13.51), $P = 0.000$		25.02 (8.43–74.30), $P = 0.000$	
Tuberculosis				
No	209	54	242	21
Yes	4	5	7	2
OR	4.96 (1.23–20.04), $P = 0.025$		3.76 (0.64–22.05), $P = 0.143$	

FVC, forced vital capacity; FEV_1, forced expiratory volume in first second; CB, chronic bronchitis; OR, Odds ratio; CI, confidence interval.
Odds ratio (OR, CI 95%, *P*-value) presented concerns a multivariate analysis, adjusted for age and sex.

severity of airways obstruction, most COPD patients were classified as GOLD stage 0, followed by stage II and stage III.

Asthma had a clear association with spirometric criteria even after the adjustment for age and sex, thus supporting the presence of severe stages of airways obstruction on diagnosis (Table 4). This association was higher for asthma than for chronic bronchitis. Emphysema was associated with a low FEV_1.

Table 5. Relationships between spirometric changes and risk factors, adjusted for age and sex (multivariate analysis – OR, CI: 95%, *P*-value)

	FEV_1 < 80%	FEV_1/FVC < 0.70
Age		
20–45 years	1	1
≥46 years	2.73 (1.52–4.92), $P = 0.001$	6.28 (2.38–16.55), $P = 0.000$
Sex		
Men	1	1
Women	0.62 (0.34–1.12), $P = 0.116$	0.67 (0.28–1.59), $P = 0.361$
Smoking status		
Never	1	1
Ex-smoker	1.64 (0.56–4.84), $P = 0.370$	2.28 (0.56–9.34), $P = 0.253$
Current smoker	3.10 (1.11–8.66), $P = 0.031$	3.21 (0.79–12.95), $P = 0.102$
Exposure to dust at workplace		
No	1	1
Yes	1.07 (0.58–1.97), $P = 0.828$	0.91 (0.36–2.26), $P = 0.834$
Cooking/heating using open fire		
No	1	1
Yes	1.67 (0.84–3.32), $P = 0.146$	0.85 (0.31–2.29), $P = 0.743$

FVC, forced vital capacity; FEV_1, forced expiratory volume in first second; OR, Odds ratio; CI, confidence interval.
For age and sex are presented crude OR.

The agreement between CRD and airways obstruction was generally poor. Indeed, for FEV_1 and FEV_1/FVC, the Kappa values were 0.057 and 0.074 for chronic bronchitis (no agreement), 0.085 and 0.014 for emphysema (no agreement) and 0.053 and 0.064 for tuberculosis (no agreement). The best agreement was reached for asthma with the FEV_1 getting a Kappa value of 0.281 (slight agreement).

Related factors

Individuals older than 46 years had a higher risk for spirometric changes confirming that age is a major risk factor for airways obstruction (Table 5). No association was found for BMI and region. After taking potential confounders into account, current smoking was clearly associated with a lower FEV_1. Those older than 46 years had a higher risk for emphysema and asthma (Table 6). Factors related to CRD were as follows: smoking for chronic bronchitis, emphysema and asthma. Exposure to dust at workplace was a risk factor for chronic bronchitis and asthma. Cooking/heating using an open fire was associated with chronic bronchitis and asthma.

Discussion

Chronic respiratory diseases are one of the leading causes of morbidity and mortality in the adult population worldwide. Data from the World Health Organization's Large Analysis and Review of European Housing and Health Status Study conducted in random samples from

Table 6. Relationships between chronic respiratory diseases and risk factors adjusted for age and sex (multivariate analysis – OR, CI: 95%, *P*-value)

	Chronic bronchitis	Emphysema	Tuberculosis	Asthma
Age				
20–45 years	1	1	1	1
≥46 years	1.05 (0.47–2.38), $P = 0.903$	9.89 (1.14–85.92), $P = 0.011$	0.96 (0.24–3.93), $P = 0.956$	2.37 (1.10–5.11), $P = 0.024$
Sex				
Men	1	1	1	1
Women	0.49 (0.23–1.08), $P = 0.075$	0.53 (0.10–2.66.08), $P = 0.429$	0.25 (0.62–1.03), $P = 0.040$	1.29 (0.57–2.94), $P = 0.547$
Smoking status				
Never	1	1	1	1
Ex-smoker	1.56 (0.37–6.55), $P = 0.547$	20.01 (1.99–201.08), $P = 0.011$	0.97 (0.09–10.03), $P = 0.982$	0.44 (0.05–3.81), $P = 0.459$
Current smoker	2.84 (0,85–9.46), $P = 0.09$	7.38 (0.49–110.32), $P = 0.147$	0.96 (0.10–8.99), $P = 0.974$	3.30 (0.95–11.50), $P = 0.061$
Exposure to dust at workplace				
No	1	1	1	1
Yes	2.24 (0.98–5.14), $P = 0.056$	2.38 (0.41–13.88), $P = 0.336$	1.40 (0.35–5.62), $P = 0.633$	2.17 (0.98–4.82), $P = 0.057$
Cooking/heating using open fire				
No	1	1	1	1
Yes	3.51 (1.28–9.66), $P = 0.015$	0.24 (0.02–2.60), $P = 0.239$	0.99 (0.08–11.79), $P = 0.995$	2.48 (0.97–6.33), $P = 0.057$

OR, odds ratio; CI, confidence interval.
For age and sex are presented crude OR.

eight European cities showed that in the year preceding the survey, 3.3% of individuals had been diagnosed or treated for asthma and 6.2% for chronic bronchitis and emphysema. One per cent suffered simultaneously from both (20).

Spirometry is the gold standard for diagnosing and monitoring the progression of obstructive lung diseases. Spirometry is essential for COPD diagnosis and provides a useful description of the severity. Specific spirometric cut-points (postbronchodilator FEV_1/FVC ratio < 0.70 or $FEV_1 < 80\%$ predicted) are used for purposes of simplicity (17). However, differences in the definition of COPD in guidelines make it difficult to quantify and to make comparisons between countries.

In our study, we used a standardized questionnaire and spirometric tests to identify airways obstruction and CRD in outpatients seeking for health care in PHC. Twenty two per cent of the individuals had an $FEV_1 < 80\%$. Asthma diagnosis (11%) had a higher agreement with obstruction according to spirometric definitions than the presence of chronic bronchitis (10%) or emphysema (2%), which could be because of the fact that asthma was severe in our population. Unfortunately, asthma severity was not assessed in our population. The concomitant diagnosis of asthma, chronic bronchitis or emphysema is common, particularly in adults aged over 50 years (21, 22). The lack of agreement between diseases and airways obstruction could also be because of underreporting of the diseases in our population.

In this study, association to asthma diagnosis was the highest in those older than 46 years. The rates of an asthma diagnosis found were well above the 4.5% median value found for instance in the European Community Respiratory Health Survey (ECRHS) (23). However, the question used in this study ('Have you ever been told by a doctor…') was different from the question used in ECRHS that took in account the previous 12 months. Yet, it was similar to the question used by Ehrlich in South Africa, where a lower overall prevalence was found (3.8%) (24).

It is important to make the distinction between asthma and COPD, even in older patients, because their optimal management must be based on different approaches (25). Diagnosis starts with specific training of professionals at different levels of the health care system making it possible to identify conveniently the symptoms and to develop programmes of prevention and treatment. The distribution of the severity of airways obstruction confirms the lack of representativeness from the general population, although the data were collected at PHC where we could find more severe stages.

As expected, smoking was clearly associated with chronic bronchitis, emphysema and asthma, suggesting a common factor for these diagnoses. Smoking was a risk factor for tuberculosis infection as documented by other authors (26). Exposure to a dust workplace and cooking using an open fire was associated with CRD, namely, with chronic bronchitis and asthma. Those risk factors seem also important for spirometric changes as tobacco was related with most of the obstruction.

A first limitation of our study is that only 274 individuals were included. However, they were the outpatients of a representative sample of PHC during a fixed period. Thereafter, major biases can be excluded. In CV, ERs are used by the population as PHC and that was the reason to include it in the study. Another limitation of our study is that we did not use the GOLD COPD definition as no bronchodilator was administered. Cape Verde is a country where tests like spirometry are not readily available because of a lack of equipment and

trained operators. For this reason we decided not to perform the bronchodilator test. Thereafter, we have studied the FEV_1/FVC ratio, a parameter that is easily measured and can be used without the need of reference equations. The fact that in our sample an $FEV_1 < 80\%$ predicted was observed in more people than $FEV_1/FVC < 0.70$ could be explained in part by a lung restrictive pattern in our participants. The results achieved for FEV_1 and its relation with CRD and expositions make the results reliable.

Conclusions

Under-report and underdiagnosis of chronic respiratory conditions seem to be a reality in CV, just as in other parts of the world. To improve diagnosis, our results reinforce the need of performing a spirometry as a routine test. This will help the clinician to diagnose correctly a CRD and to choose the most adequate treatment according to severity of the disease.

Acknowledgments

This study was performed under the collaboration program of the Health Ministries of Portugal (Direcção Geral de Saúde) and CV, within the frame of Chronic Respiratory Diseases. The authors acknowledge Dr Paolo Matricardi, Dr Eva Matzouranis and the GARD Executive Committee for their contribution. The authors also acknowledge the help of Dr Nila Godinho (Instituto Nacional de Estatística de Cabo Verde) with the database.

References

1. Bousquet J, Dahl R, Khaltaev N. Global alliance against chronic respiratory diseases. Allergy 2007;**62**:216–223.
2. Pauwels R. COPD: the scope of the problem in Europe. Chest 2000; **117** (Suppl. 2): 332S–335S.
3. Khaltaev N, Bousquet J. Global surveillance, prevention and control of chronic respiratory diseases: a comprehensive approach. http://www.who.int/gard/publications/GARD%20Book%202007.pdf. Date last accessed: May 2008.
4. Pauwels RA, Rabe KF. Burden and clinical features of chronic obstructive pulmonary disease (COPD). The Lancet 2004;**364**:613–620.
5. Viegi G, Pedreschi M, Pistelli F, Di Pede F, Baldacci S, Carrozi L et al. Prevalence of airways obstruction in a general population: European Respiratory Society vs American Thoracic Society definition. Chest 2000, **117**(Suppl. 2): 339S–345S.
6. Celli BR, Halbert RJ, Isonaka S, Schau B. Population impact of different definitions of airway obstruction. Eur Respir J 2003;**22**:268–273.
7. de Marco R, Accordini S, Cerveri I, Corsico A, Sunyer J, Neukirch F et al. An international survey of chronic obstructive pulmonary disease in young adults according to GOLD stages. Thorax 2004;**59**:120–125.
8. Halbert R, Natoli J, Gano A, Badamgarav E, Buist AS, Mannino D. Global burden of COPD: systematic review and meta-analysis. Eur Respir J 2006;**28**:523–532.
9. Bousquet J, Ndiaye M, Aït-Khaled N, Annesi-Maesano I, Vignola AM. Management of chronic respiratory and allergic diseases in developing countries. Focus on sub-Saharan Africa. Allergy 2003;**58**:265–283.
10. Janson C. The effect of passive smoking on respiratory health in children and adults. Int J Tuberc Lung Dis 2004;**8**:510–516.
11. United Nations Development Programme. Human Development Report 2007/2008. Fighting climate change: Human solidarity in a divided world. http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf. Date last accessed: May 2008.
12. Rosado-Pinto J, Morais-Almeida M. Asthma in developing worlds. Pediatr Pulmonol 2004;**26**:66S–68S.
13. Buist AS, Vollmer WM, Sullivan SD, Weiss KB, Lee TA, Menezes AM et al. The Burden of Obstructive Lung Disease (BOLD) Initiative: rationale and design. COPD 2005;**2**:277–283.
14. Miller MR, Hankinson J, Brusasco V, Burgos R, Casaburi R, Coates A et al. Standardisation of spirometry. Eur Respir J 2005;**26**:319–338.
15. Quanjer PH, Tammeling GJ, Cotes JE, Pederseii R, Peslin R, Yernault JC. Lung volumes and forced ventilatory flows. Report of working party, standardization of lung function tests, European Community for Steel and Coal. Official statement of the European Respiratory Society. Eur Respir J 1993;**6**:5–40.
16. Pennock BE, Cottrell J, Rogers R. Pulmonary function testing: what is normal? Arch Intern Med 1983;**143**:2123–2127.
17. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. http://www.goldcopd.com/Guidelineitem.asp?|1=2&|2=1&intId=2003. Date last accessed: May 2007.
18. Altman DG. Practical statistical for medical research. London: Chapman & Hall, 1990.
19. Landis JR, Koch CG. The measurement of observer agreement for categorical data. Biometrics 1977;**33**:159–174.
20. Boutin-Forzano S, Moreau D, Kalaboka S, Gay E, Bonnefoy X, Carrozzi L et al. Reported prevalence and co-morbidity of asthma, chronic bronchitis and emphysema: a pan-European estimation. Int J Tuberc Lung Dis 2007;**11**:695–702.
21. Viegi G, Matteelli G, Angino A, Scognamiglio A, Baldacci S, Soriano JB et al. The proportional Venn diagram of obstructive lung disease in the Italian general population. Chest, 2004;**126**:1093–1101.
22. Viegi G, Pistelli F, Sherrill DL, Maio S, Baldacci S, Carrozzi L. Definition, epidemiology and natural history of COPD. Eur Respir J 2007;**30**:993–1013.
23. Janson C, Anto J, Burney P, Chinn S, de Marco R, Heinrich J et al. European Community Respiratory Health Survey II. The European Community Respiratory Health Survey: what are the main results so far? Eur Respir J 2001;**18**: 598–611.

24. Ehrlich R, White N, Norman R, Laubscher R, Steyn K, Lombard C et al. Wheeze, asthma diagnosis and medication use: a national adult survey in a developing country. Thorax 2005;**60**:895–901.

25. Celli BR, MacNee W. Standards for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. Eur Respir J 2004;**23**:932–946.

26. Boon S, van Lill SW, Borgdorff MW, Verver S, Bateman ED, Lombard CJ et al. Association between smoking and tuberculosis infection: a population survey in a high tuberculosis incidence area. Thorax 2005;**60**:555–557.

